during the greater part of the month, when the rate begins to rise on account of the trees shedding their foliage. By the latter part of September the rate of evaporation is at its lowest expression during the period under observation, namely, from May to October, inclusive. This low rate of September forms a striking contrast to the high rates of much of June and all of July and August, the usual flowering period of this species. It is during this period of low evaporation that the stems of the Indian pipe spring up, flower and mature their fruit.

From the above data it would seem that the Indian pipe is a mesophyte, but so far from being confined to mesophytic woods, is able to persist in decidedly xerophytic areas. It seems, however, to be confined to woods. This persistence is determined by the short aerial life of the plant, and not by the formation of any xerophytic structures.

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Literature Cited

1. Coulter, S., A Catalogue of the Flowering Plants and the Ferns and their Allies Indigenous to Indiana. Indiana Dept. of Geology and Natural Resources. 24th Annual Report, pp. 553–1002. 1899. Data concerning the Indian pipe is given in pp. 867–868.
2. Cowles, H. C., The Ecological Relations of the Vegetation on the Sand Dunes of Lake Michigan. Bot. Gazette 27. 1899. The oak dunes are described in pp. 379–382.
3. Schimper, A. F. W., Plant-geography upon a Physiological Basis, pp. 610–612. Oxford, 1903.
4. Fuller, G. D., Evaporation and Plant Succession on the Sand Dunes of Lake Michigan. Transactions Illinois State Academy of Science 4: 119–125. 1911.

TWO NEW TERTIARY SPECIES OF TRAPA

By Edward W. Berry

The genus *Trapa*, formerly included in the family Onograceae, is now made the type and only genus of the Hydrocaryaceae (Trapaceae, Dumort, 1827). There are three existing species, all aquatics, and all confined to the Old World except for the naturalization of *Trapa natans* L., in New England and New York. The latter species is found irregularly scattered throughout central and southern Europe, its area of distribution being a contracting

one as shown by its occurrence in post-glacial deposits at very many localities beyond its present range in Russia, Finland, Sweden and Denmark. The two other existing species are *Trapa bicornis* L., and *Trapa bispinosa* Roxb., of southeastern and southern Asia and said also to occur in Africa.

The genus has an extended geological history. Rosettes supposed to represent the floating leaves (*Trapa ? microphylla* Lesq., and *Trapa ? cuneata* Knowlt.) are widespread in the Rocky Mountain province in beds of late Cretaceous and early Tertiary age. The oldest recognizable fruits are a large bi-cornute form from the Eocene of Canada and Alaska and *Trapa wilcoxensis* described in the following paragraph. An Oligocene species (*Trapa Credneri* Schenk) has been described from Saxony, and no less than seven species have been described from the Miocene—two occurring in Idaho (Payette formation), one in Japan and the balance in Europe, where two species continue into the Pliocene. A species from the late Pliocene of America is also described in the present note. The existing *Trapa natans* has been recorded from the preglacial beds of England and Saxony and from very many interglacial and postglacial deposits in Portugal, Italy, Netherlands, Germany, Sweden, Russia and Denmark, Gunnar Andersson in a recent paper (1910) mentioning 18 localities in West Prussia, 6 in Denmark, 17 in Sweden and 29 in Finland. With this short prefatory statement the two following species may be briefly characterized.

Trapa wilcoxensis sp. nov.

Fruit relatively small, rhomboidal in outline, wider than high, indehiscent, coriaceous, armed with two more or less extended, laterally directed or ascending (not recurved) horns. Width 1.3 cm. to 1.8 cm. Height 7 mm. to 9 mm. Somewhat compressed (naturally), expanded medianly, broad and extended below, more or less extended and rounded above. Horns stout, conical, more or less extended. Surface more or less tuberculate medianly. Figs. 1–3.

This species comes from the middle Wilcox of the Lower Eocene at Peryear, Henry County, Tennessee. It shows considerable variation in size and relative development of horns and

is not particularly close to any previously described form. While much smaller than the existing species it is clearly referable to *Trapa*. It is a curious fact that nearly all of the North American *Trapa* have two horns like the existing Asiatic species instead of four as is normally the case in the existing European species.

Trapa alabamensis sp. nov.

Coriaceous nuts, rhomboidal and roughly bilateral in outline, much swollen and tuberculated medianly, with normally two, short, conical, acuminate, slightly recurved horns. The base is rounded and shows a conspicuous scar. The sides are somewhat unsymmetrical and faintly and irregularly ribbed and usually show three large tubercles on each face above the middle. The base is large and full. The apex is but slightly produced or truncated. Length from tip to tip of the horns about 4 cm. Height about 2 cm. Figs. 4, 5.

FIG. 1. Fruits of Tertiary *Trapa;* 1–3, *Trapa wilcoxensis* from Lower Eocene of Tennessee; 4, 5, *Trapa alabamensis* from the Pliocene of Alabama.

The present species is very close to the existing *Trapa natans* especially to the two horned variants (the species is normally four horned). The latter is larger and more symmetrical with stouter more recurved horns, and a more extended apex as well as a stouter and more symmetrical body. The present species is common in the late Pliocene clays of Red Bluff, Perdido Bay, Baldwin County, Alabama, and inland from the present Gulf coast to elevations of over 300 feet near Lambert, Mobile County, Alabama.

Both of these new species are of great interest since they are the first recorded indigenous forms from the eastern United States and show that the genus was present in this area throughout the Tertiary. They also throw an interesting light on the conditions of sedimentation at the time of their existence.

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SHORTER NOTES

Whorled Leaves in *Gentiana*.—In his notes on the flora of Copake Falls, N. Y., Sereno Stetson describes and gives an illustration of an unusual leaf arrangement in *Gentiana quinquefolia* L., where whorls of three are shown instead of the normal opposite phyllotaxis in *Gentiana*. Information is requested from those knowing a similar case. There is one in my herbarium of *G. Andrewsii* Griseb., which I collected by Chautauqua Lake, at Mayville, N. Y., September, 1907. One stem among those taken has four whorls of three leaves, those of the uppermost nodes below the leaves subtending the cluster of flowers at the top. The stem was cut off near the root, and was about 4 dm. high, 2 dm. being occupied by the verticillate leaves. The four lower nodes represented on the stem have the leaves opposite, so that the entire stem does not share in the abnormality. One leaf in the upper whorl has a flower in its axil. The only mention I have seen of a similar case, except that of Mr. Stetson, is by Dr. O. Penzig in his Pflanzen-Teratologie (2: 155. 1894). Under *Gentiana asclepiadea* L., a plant of southern Europe, he says: "Whorls of leaves with three members in place of the pair, not rare."

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